

NASA TECH BRIEF



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GERT Simulation Program for GERT Network Analysis

The problem:

To develop a method to obtain statistics on specified nodes of GERT networks in determining which branch of the network should be taken and how long it would take.

The solution:

The GERT Simulation Program simulates GERT networks to obtain statistics on specified nodes of the network. It performs sampling experiments to determine which branches of the network are taken and how long it takes to traverse a branch of the network.

How it's done:

The program for simulating GERT networks involves the use of the GASP IIA simulation knowledge. Knowledge of simulation techniques and GASP IIA is not necessary in order to use the GERT Simulation Program. The input to the program is a description of the network in terms of its nodes and branches along with control information for setting up the simulation conditions. After receiving the network to be simulated from the input data and the number of simulations of the network to be performed, the program automatically performs a simulation by selecting branches to be traversed based on random numbers, and the time it takes to perform the activities represented by the branches which are based on samples from the distributions inserted as input information. Statistics are automatically collected on nodes as specified by the user of the program. When all simulations requested by the user have been completed, a summary report which describes the network simulated and the final results are printed. The final results include the following statistics:

1. The probability that a specified node is realized
2. The average time to realize the specified node
3. An estimate of standard deviation of the time to realize the specified node
4. The minimum time observed to realize the specified node
5. The maximum time observed to realize the specified node
6. A histogram of the times to realize the specified node

A user of the GERT Simulation Program need only be familiar with the input specifications in order to simulate a GERT network.

The program performs a simulation by advancing time from event to event. In simulation parlance this is termed a next event simulation. The events associated with a GERT network are:

1. Start of the simulation, and
2. End of an activity.

The start event causes all source nodes to be realized and schedules the activities emanating from the source nodes according to the output type of the source node. The output type for all nodes is either deterministic or probabilistic. In the former case, all activities emanating from the node are scheduled and, in the latter case, only one of the activities emanating from the node is scheduled. By scheduling an activity is meant that an event "end of activity" is caused to occur at some future point in time. A next event simulation proceeds from event to event until the conditions which indicate that the simulation is completed are obtained. For the simulation of GERT networks, all events involve end of activity times and the simulation of the network proceeds from one end of activity time to another.

(continued overleaf)

Notes:

1. This program is written in the GASP IIa programming language which in turn is written in Fortran IV as specified by the IBM 1130 computer.
2. The number of nodes that can be accommodated by the program is dependent upon the storage capacity of the machine being used. The present version of the program is dimensioned to permit a network with 30 nodes and 40 branches. This assumes that the machine being used has only 8000 words of core storage.

3. Inquiries concerning this innovation may be directed to:

COSMIC
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University of Georgia
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Reference: B68-10457

Patent status:

No patent action is contemplated by NASA.

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